

JOBO TRICOLOR ANALYSER
WITH DIGITAL TIMER

COLOR STAR

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ACCESSOIRES:

TABLE OF APPROXIMATE SETTINGS
TEST NEGATIVE 35 mm. AND PRINT OF IT
SHEET OF DIFFUSER MATERIAL

AVAILABLE ON REQUEST:

TEST NEGATIVES 60x60 mm. AND TEST TRANSPARENCIES BOTH SIZES.
DEVICE FOR MEASURING A.O. SLIDES ON SLIDE-DUPLICATORS
(can be attached to the sensor probe).

DESCRIPTION OF THE COLORSTAR.

1. Outlet for enlarger. Max. 1320 VA at 220 Volts operation or 1100 VA at 110 Volts operation.
2. Outlet for darkroom safelight. Will automatically be switched off during measurement and exposure.
In general only needed for black and white printing.
3. Mains cord. Please check for correct supply voltage, 110 or 220 Volts. Mains frequency 50-60 cycles.
4. Fuse 6,3 Amps for 220 Volts operation or 10 Amps for 110 Volts.
5. On/off switch. For best accuracy instrument should be warmed up for a few minutes. Measurement does not function normally at daylight or direct artificial lighting but only in darkroom light levels. However, cell cannot be damaged by strong light.
6. FUNCTION SELECTOR. See text.
7. START pushbutton. Initiates exposure.
8. Sensor connector. Engage sensor plug and lock with ring.
9. RECIPROCITY switch. See text.
10. SENSITIVITY control. Influences exposure time.
11. MAGENTA color control. Adjusts for sensitivity of enlarging paper to green light, influenced by Magenta filter.
12. YELLOW color control. Adjusts for blue/yellow sensitivity. Y and M controls together influence Cyan/red behaviour.
13. Color star with led indicators.
14. Exposure time display: 00.0 to 99.9 seconds. Exposure times below 2 seconds not advised, because exposure lamp warm-up changes color.
15. SENSOR switch with CHROME/COLOR settings for color negatives, or transparencies on chrome papers.
Chrome setting also to be used for black and white.
16. Diffusor for part-integral measurement. Situated on rotatable sensor top. Turn until arrow becomes visible in large spot opening.
17. Large spot measuring opening (10 mm.). From part-integral setting turn sensor top 180 degrees to set this opening in front of light conductor. This setting is preferred for large printing sizes. It provides more sensitivity than part-integral method.
18. Spot 7 mm. Turn sensor top 2 stops past large spot opening. This setting is preferred for most sizes. Sensitivity is approx. equal to that when measuring part-integral.
19. Small spot 4 mm. Turn 2 stops other side. Use only for small size work or when light is sufficiently intense.
20. Shadow indicator. Only needed with spot measuring. To ensure that the light falls directly on the light conductor. When measuring in the corners of the image the sensor needs to be tilted in such a way that the shadow of the ball projects on the dot.

SPECIFICATIONS.

Sensitivity control range: Log density factor = 2.40 (linear 1:250).

Y and M control range: 140 densitometric filterpoints.

Y, M and C indicators: 3x12 leds. The first led lights up between 01 and 02 filterpoints offset, each following led at an additional 04 filterpoints.

Electrical power consumption: approx. 6 VA.

Dear Customer,

Thank you for purchasing the COLORSTAR ANALYSER. We are sure you will find it a worthwhile investment. Before putting it to use, please read through these instructions.

1. SETTING UP

Fit a 3 pin plug to the mains lead (3), ensuring that the wires are connected to the correct pins. The color coding of the wires as follows: Brown to the pin marked LIVE
Blue to the pin marked NEUTRAL
Yellow/Green to the pin marked EARTH

Now connect the mains lead to the COLORSTAR via the special socket located at the rear of the body and marked 220 Volts AC. Connection of the enlarger to the COLORSTAR is made via a 13 amp., 3 pin plug.

The COLORSTAR is designed to switch off the safelight automatically when analysing or exposing. If you are using the COLORSTAR for color printing do make sure that the safelight is 'safe' for the material you are using.

You should now connect the SENSOR PROBE to the analyser. The connection is by a 5 pin DIN plug (8). Please connect it carefully, taking care not to force it. It will only fit one way. When you have inserted the connector you should lock it into place by twisting the locking ring in a clockwise direction.

You may now plug the mains lead into your electricity supply.

NOTE: Although the COLORSTAR will not operate correctly in daylight or direct artificial light, no damage will be caused by switching on under these conditions.

Switch on by using the rocker switch located at the upper right side of the front panel (5).

Just beneath the ON-OFF switch you will see another switch marked ANALYSE - HOLD - EXPOSE (6).

Move this switch upwards to 'ANALYSE'.

You will now see that either the YELLOW and MAGENTA or possibly the YELLOW and CYAN indicators (13) will light up and a figure will appear in the 'SECONDS' window (14).

Now move the switch from 'ANALYSE' position to the 'HOLD' position. The indicator lights should go out and the 'SECONDS' figure should remain steady.

If all these things have happened then you can go ahead and learn how to use the COLORSTAR.

Please note that the analyser is protected by a 6.3 amp. cartridge fuse. Should this fuse need replacing this may be done by unscrewing the fuse holder which is situated at the rear of the analyser (4). This type of fuse may be obtained from radio-shops.

Now let us look at the various controls.

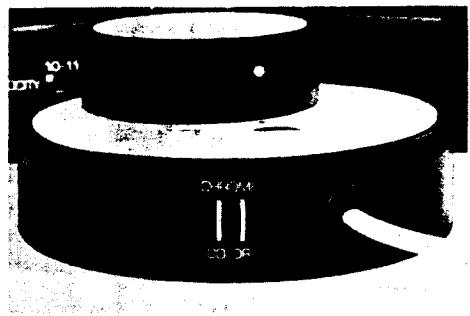
2. CHROME/COLOR SWITCH (15).

This is located on the side of the SENSOR PROBE and is marked CHROME on the top and COLOR on the bottom.

When printing from color negatives this switch should always be set at COLOR.

When printing from transparencies it should be set to CHROME.

This switch adjusts the COLORSTAR for the difference in sensitivity to light between the different papers which are used for printing from color negatives, and those that are used for printing from transparencies. Negative printing papers suffer a lack of 'yellow' sensitivity and transparency printing papers are less sensitive to the 'red' end of the spectrum. The COLORSTAR allows for these differences.



3. RECIPROCITY SWITCH (9).

This is located on the left side of the front edge of the COLORSTAR and is marked '1.0 - 1.1 - 1.2'.

Different papers have a different sensitivity to light, particularly when long exposure times are required. As exposure times increase some papers need extra amounts of exposure to achieve a perfect result. This is known as 'reciprocity failure' and differs with different types of paper.

Below is a table showing the reciprocity and sensor switch positions for some of the popular material but do remember that as new materials come on to the market they may have changes in their sensitivity. So, if in doubt, ask the manufacturer about the reciprocity value of the material or do a small test yourself to find the right position for a specific material.



| | RECIPROCITY | SENSOR SWITCH |
|---------------|-------------|---------------|
| AGFA COLOR | 1.0 | COLOR |
| AGFACHROME | 1.0 | CHROME |
| CIBACHROME | 1.2 | CHROME |
| EKTACOLOR | 1.2 | COLOR |
| EKTACHROME | 1.2 | CHROME |
| BLACK & WHITE | 1.0 | CHROME |

You see that the COLORSTAR automatically corrects for reciprocity failure providing you set the switch at the correct position. Not many papers have, at present a reciprocity value of 1.1 but this is provided for use with any future materials that may come on to the market.

4. COLOR FILTRATION CONTROLS.

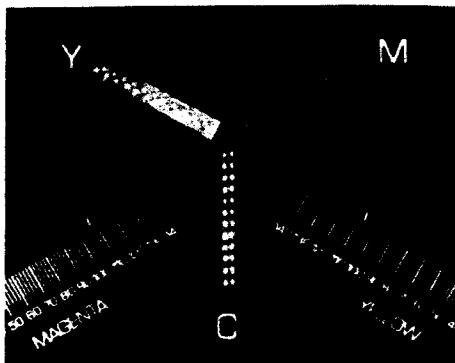
On the control panel you will see two sliders which are marked respectively MAGENTA (11) and YELLOW (12).

It may surprise you to notice that there is no slider for CYAN - but don't worry - more about that later.

Move the 'ANALYSE - HOLD - EXPOSE' switch back to 'ANALYSE'. The filtration LEDs (13) will now light up again.

Now experiment by moving the YELLOW slider along. You should see the yellow LEDs either lighting up or going out. Do the same with the MAGENTA slider and the magenta lights will also either light up or go out. If you move the CHROME/ COLOR switch to CHROME you will see that the CYAN lights light up.

To eliminate these you should move both the YELLOW and MAGENTA sliders at the same time. A little experiment with this and you will be able to alter any of the three sets of LEDs.



While you are moving these sliders about you will notice that the SECONDS reading keeps changing. This shows you that when you alter the 'filtration' values the COLORSTAR will automatically change the exposure value. Note that the exposure value is accurate to one tenth of a second. So the COLORSTAR is VERY sensitive !

5. SENSITIVITY SLIDER (10).

Every different batch of printing paper has a slightly different sensitivity to exposure light. It is necessary, therefore, to be able to adjust the COLORSTAR to the current batch of paper. If you leave the YELLOW and MAGENTA sliders alone, but move the SENSITIVITY slider you will see that the SECONDS figure changes. Once you have set the analyser for a batch of paper there should be no need to alter the SENSITIVITY control.

6. START BUTTON (7).

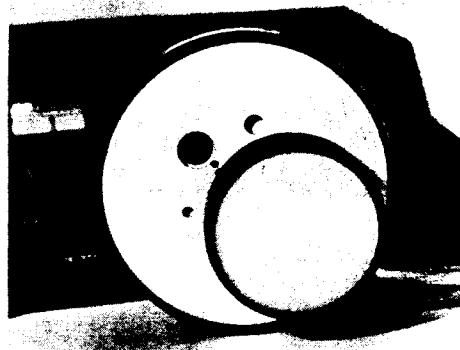
When this button is depressed, the COLORSTAR will automatically switch the enlarger on and keep it switched on for the amount of time shown on the SECONDS readout. So you can now understand that, once you have set every thing up, the COLORSTAR will automatically do the rest.

7. SENSOR PROBE.

There are 5 different ways of measuring with the SENSOR probe.

If you examine the sensor you will see that the top part may be rotated (16). On it there are three holes - a large one in the middle and a smaller one on either side of it. The large one is 10 mm. in diameter (17), the middle one is 7 mm. (18) and the small one is 4 mm. (19). The round part on top has an inbuilt diffuser (16). Its use will be explained shortly.

Play about with the rotatable part until you can easily set one of the holes over the round black sensor. If you turn the top part until a black triangle appears in the 10 mm. hole, you have then set it to use the diffuser part. Move it four notches to the left and the 4 mm. spot will come into use.



Now move it two more notches to the left and the 10 mm. hole will be the operative one. Finally, move it two more notches to the left and the 7 mm. hole will be the operative one. You may move the top in either direction without doing any damage.

You may have notice that, as you change from one size hole to another, that the SECONDS readout changes.

IT IS IMPORTANT TO NOTE THAT YOU CANNOT CHANGE FROM ONE TYPE OF READING TO ANOTHER IN THE MIDDLE OF USING THE ANALYSER.

Exposure times up to 99.9 seconds may safely be used. Above that time the symbols EEE appear in the SECONDS window, indicating an ERROR condition. Under these conditions you must open the enlarging lens aperture to reduce the exposure time.

An intermittent flashing of the yellow LEDs indicates that the light is too weak for the accurate measurement of the color analysis. If that happens you must open the diaphragm a stop or two to obtain the filtration adjustments and then close down the aperture to obtain the correct exposure time or lower the head of the enlarger just when setting the filters.

You will see that there is a small red pin set into the SENSOR and underneath it is a small black spot (20). When you are measuring from the edges of a frame you should tilt the SENSOR so that the shadow of the red ball is in line with the black spot. This ensures that the light from the enlarger enters the sensor holes at the correct angle. This is only needed for 'spot' measuring.

Now we have explained the use of each of the 'knobs' and 'dials' let us do a 'dry run'.

Connect the COLORSTAR to your enlarger.

Dial into your enlarger some filtration that you would normally use.



Let us suppose that we have a setting of 85 Y, 50 M, 00 C and that the exposure time from a test was 15 seconds at f 8. Set the aperture at f 8.

Switch out the darkroom lights.

Set the switch to ANALYSE.

Place the SENSOR under the enlarger on the baseboard.

Adjust the YELLOW and MAGENTA sliders until all the LEDs go out.

If the CYAN LEDs need to be extinguished you will have to adjust the YELLOW and MAGENTA sliders together (that is why there is no need for a CYAN slider!).

When all the lights are out, adjust the SENSITIVITY slider until the exposure time shows 15 seconds.

Now switch to HOLD. The analyser is now calibrated both for filtration and for exposure.

Move the switch to EXPOSE and depress the START button. The enlarger will light up and expose for the exact amount of time shown on the SECONDS readout. The enlarger will then be automatically switched off.

Once you have managed all this you have succeeded in mastering all the controls.

Now read on.

SENSITIVITY AND COLOR CONTROLS.

Each batch of printing paper differs slightly in color and exposure sensitivity, so, for each new batch you buy, you will need to adjust the color and sensitivity controls.

The use of the test negative provided with the COLORSTAR will facilitate this and the settings found for that batch of paper are valid for all films independent of brand, masking and exposure.

So you can print daylight, artificial light and flash photos at the same time without needing to readjust the control settings, AS LONG AS YOU ARE PRINTING FROM THE SAME BATCH OF PAPER.

The separate table shows some approximate settings for part-integral measurement. Please note that they are only approximate rough guidelines.

HOW TO MAKE CORRECTIONS TO THE APPROXIMATE SETTINGS.

First adjust the controls to the approximate settings and measure with the sensor set at the PART-INTEGRAL setting (that is, with the black triangle set in the 10 mm. hole) on the projected image of your negative, or of the test negative.

Make your first print which, in general, will show color balance and density faults.

First note which color is dominant.

If, for instance, your print turns out to be too yellow you will have to reset the yellow control to a higher value. The same goes for other colors.

Please study the table below and note that transparencies work the opposite way.

| NEGATIVE TRANSPARENCY PRINT IS TOO | MAGENTA GREEN | BLUE YELLOW | CYAN RED | GREEN MAGENTA | YELLOW BLUE | RED CYAN |
|---------------------------------------|------------------|----------------|-------------|------------------|----------------|-------------|
| RESET M CONTROL | + | | — | — | | + |
| RESET Y CONTROL | | — | — | | + | + |

+ means set to a higher reading. — means set to a lower reading.

If you are not sure by how much you should alter the color controls you may find a set of Kodak viewing filters useful.

For Kodak values of 10 20 40

Adjust COLORSTAR by approximately 8 15 30 points.

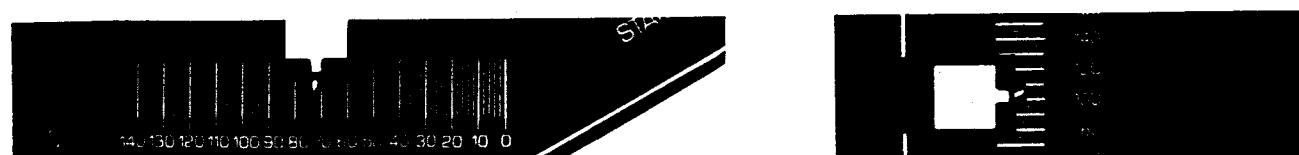
You should now adjust the SENSITIVITY control as follows:

If your negative print is too HEAVY - or your transparency print is too LIGHT - the SENSITIVITY control should be set to a higher reading.

Thirty points has about the same effect as one stop less on your lens.

If, on the other hand, the print from the negative is too LIGHT or that from the transparency is too HEAVY, the SENSITIVITY control should be changed to a lower reading.

HOW TO READ THE YELLOW, MAGENTA AND SENSITIVITY CONTROLS.



On the YELLOW and MAGENTA controls the thin lines indicate the even numbers.

So, between 70 and 80 you read 72 - 74 - 76 - 78. Odd numbers may be estimated.

Estimating between the lines gives you an accuracy of one half a filter point. Even an accuracy of between, say, 72 and 74 gives you an accuracy of 1 filter point which is undetectable by most eyes.

SENSITIVITY control readings have 5 points intervals. It is not possible to read accurately to one point but this is not critical. One point error represents an error of only 0.1 of a second in an exposure time of 4 seconds. So don't worry too much about being a fraction out on your reading.

USING THE 'ANALYSE - HOLD - EXPOSE' SWITCH.

SET TO THE 'ANALYSE' POSITION.

If you start measuring with 0 - 0 - 0 filtration set on your enlarger colorhead you will usually see that two color indicators on the COLORSTAR are fully or partially lit. In the case of negatives these are normally the YELLOW and MAGENTA LEDs. (If, by the way, you find that the CYAN LEDs are lit, examine the CHROME/COLOR switch and make sure it is set at the COLOR position).

You should now adjust the YELLOW and MAGENTA sliders until all the lights are extinguished.

The easiest way is to adjust the YELLOW slider until only a couple of LEDs remain lit, and then adjust the MAGENTA slider. This is because with some filters, increasing the MAGENTA will also affect the YELLOW.

If the CYAN LEDs light up you will have to decrease both the YELLOW and MAGENTA values. DO NOT USE THE CYAN FILTER ON THE ENLARGER HEAD TO ADJUST CYAN. As you are most probably aware - using all three filters on the enlarger head is of no value. It merely acts as a neutral density filter and the only effect is to necessitate an increase of exposure time.

With a transparency in the enlarger you will usually find that the CYAN LEDs are predominant. Don't forget, when printing from transparencies, to make sure that the CHROME/COLOR switch is set to CHROME.

'HOLD' or 'STORE'

When you have set the YELLOW, MAGENTA and SENSITIVITY sliders to your satisfaction you then switch to 'HOLD'/'STORE'. This will 'freeze' the exposure time and this time will be stored.

'EXPOSE'

By switching to EXPOSE the enlarger will be switched off (and, incidentally, the safe-light if you have it connected).

'START'

The exposure will be made by pressing the START button and the enlarger will be lit for the amount of time shown on the SECONDS display.

It is not advisable to use exposure times of less than 2 seconds because of possible changes of color temperature due to the warm-up time of the lamp.



DIFFERENT MEASURING METHODS.

As you have seen from your preliminary inspection of the COLORSTAR, the rotatable sensor top has three openings for spot measurement and one for part-integral measurement. That represents four of the possible ways of measuring.

The fifth is an integral measurement of the WHOLE negative and this is achieved by placing the sheet of diffuser material (which comes with the COLORSTAR) approximately 50 mm. (2 inches) below the lens. If your enlarger has a holder for a red filter this could be utilised for holding the diffuser material.

DO REMEMBER, HOWEVER, THAT IF YOU SET UP FOR EACH OF THESE TYPES OF MEASUREMENT YOU CANNOT CHANGE HORSES IN MID STREAM. EXPERIENCE WILL TELL YOU WHICH IS THE BEST TO USE. IN ANY CASE, IT IS WORTH WHILE DOING A TEST ON ALL OF THEM AND NOTING THE INFORMATION IN A TABLE AS SHOWN BELOW:

| | SENSITIVITY | MAGENTA | YELLOW |
|-----------------|-------------|---------|--------|
| 4 mm. spot | | | |
| 7 mm. spot | | | |
| 10 mm. spot | | | |
| part-integrated | | | |
| full-integrated | | | |

Our advice is to start with the PART-INTEGRAL method. Less errors are made when using this method and it is the easiest to learn. Later on you can try spot measurement using skin tones or grey. Professional photographers do take one shot of a grey card or skin tone when starting to make photographs under certain light conditions. That negative or slide is used to determine the correct filtering, valuable for all the photographs taken with same kind of light source.

UV FILTER.

If your enlarger does not have an inbuilt UV filter you should use one. Most modern color enlargers do have UV filtration built in but do check.

PART INTEGRAL MEASUREMENT.

This is the easiest 'general' method for all sorts of subjects - contrary to spot measurement which requires a skin tone or grey tone or some specific color measurement.

Part integral measurement still requires you to learn the correct technique. This system measures the 'average color' of the subject and you should always position the sensor where there is a mixture of color in the frame.

If you place the sensor in an area where there is a predominately single color such as green grass the COLORSTAR WILL SEE THE WHOLE PICTURE AS PREDOMINATELY GREEN and give you the wrong result.

So find the best 'neutral' part of the negative and use that. The following hints should be followed:

1. Examine the projected image and set it up ready for printing. If there are people in the picture try to get a measurement from their heads by placing the sensor over that area.

2. If you see any large area of one color such as CYAN or MAGENTA avoid them. They represent highly saturated areas of RED or GREEN in the positive image and will certainly cause measuring errors.

Also avoid exceptionally dark or light areas but look for a part with an average density. Usually your best subjects are people, animals, brick, wood or any area which is not dominated by highly saturated colors.

3. Once you have found the right spot, adjust those filters at the colorhead that are indicated by the COLORSTAR until all the LEDs are out.

Switch to STORE. Take the sensor away. Switch to EXPOSE. Then start the exposure by pressing the START button.

4. First try some easy pictures. Once you have gained some experience take something a little more tricky that may need special treatment.

Suppose your picture shows a very white boat on a pale blue sea then, according to the rules, there is no way to measure it. However, using a little trick, we can get a result:

Measure on the blue sea but this time adjust the filtration until 2 MAGENTA and 5 CYAN LEDs are lit. This will automatically correct for the difference between the 'average' color that was programmed and the 'blue' sea that was measured and should yield a reasonable print.

Below is a table for other 'dominant' colors. Once you have worked with it you should be able to easily add more colors to the list. This list indicates the number of YELLOW, MAGENTA or CYAN LEDs that need to be lit.

| SUBJECT | NEGATIVE PRINTING | | | TRANSPARENCY PRINTING | | |
|---|-------------------|----|---|-----------------------|----|----|
| | Y - M - C | | | Y - M - C | | |
| Green like grass or leaves | 1 | 0 | 6 | 10 | 12 | 0 |
| Blue sky - pale blue sea | 0 | 2 | 4 | 8 | 4 | 0 |
| White with surrounding colors | 0 | 0 | 2 | 4 | 4 | 0 |
| White only (check exposure time somewhere else) | 0 | 2 | 4 | 8 | 4 | 0 |
| Skin tone (when enlarging to such an extent that the complete diffuser is covered by skin tones) | 5 | 0 | 0 | 0 | 10 | 10 |
| Fire red | 10 | 10 | 0 | ----- | | |

You should also take note of the subject density. If it does not look average then only obtain the filtration setting this way and then move the sensor to an average density spot to obtain a better exposure time.

After a little practice you will soon get the hang of it.

SPOT MEASUREMENT.

The only difference between part integral and spot measurement is that the opening is so much smaller and you cannot find average mixtures so easily. But it does allow you to measure one separate color very exactly - for example, skin tones or grey card. Be aware of the fact that if one color in a photograph is correct, ALL COLORS ARE O.K. !

However, do not forget to set the controls for the appropriate spot you are using.

When using different spot diameters you have to find the appropriate settings by programming also with the same holes.

It is important to ensure that the sensor is directionally sensitive when spot measuring by the use of the little red ball and the black spot as described in an earlier part of these instructions. Particularly at the edges of a frame, tilt the sensor so that the shadow of the ball covers the black spot.

FULL INTEGRAL MEASUREMENT.

Fully integrated measurement of the whole negative is a quick and simple method but it does have some limitations.

First, it is important that the negative is framed correctly and that only one size of negative should be used for the same programme settings.

The measuring is done with the large (10 mm.) spot with the diffuser held at a fixed distance of approximately 50 mm. (2 inches) from the lens.

To obtain the programme settings you should choose a negative with average colors and density (do not use the test negative provided as it has too many saturated colors).

Place the diffuser under the lens. The 10 mm. spot should be right under the lens. Check the shadow spot. Now reset the YELLOW and MAGENTA sliders until all the LEDs are extinguished. Now move the SENSITIVITY control until the correct exposure time appears in the SECONDS window.

You have now obtained the S - M - Y settings for the integrated measurement.

This method may be used for a series of simple prints when you do not expect to achieve the highest quality possible. With some practice you can compensate for some of the color dominants by the method described for part integral measuring.

BLACK AND WHITE.

Set the colorhead to 0 - 0 - 0 filter settings.

Adjust the RECIPROCITY switch and set the CHROME/COLOR switch on CHROME.

Set the MAGENTA control to 140 and the YELLOW control to such a value that when measuring the black and white negative all the YELLOW and CYAN LEDs are out.

Obtain the correct exposure time for one negative by any other method.

Shift the SENSITIVITY control until this appears in the SECONDS window.

Note this S value as the sensitivity for that box of paper.

To obtain the contrast of a black and white negative first measure the lightest part of the negative where any detail is still visible and note the exposure time. Then measure the darkest area which also has any detail. Let us say that the two times are 2 secs. and 7 secs. respectively.

Divide the 7 by the 2. Result is 3½. This is the contrast ratio.

Below is a table of contrast ratios for Black and White papers.

| PAPER GRADE | CONTRAST RATIO | PAPER GRADE | CONTRAST RATIO |
|-------------|----------------|-------------|----------------|
| EH | 2 | 5 | 3 |
| H | 3½ | 4 | 5 |
| N | 5½ | 3 | 8 |
| Sp | 10 | 2 | 12 |
| S | 17 | 1 | 20 |
| ES | 30 | 0 | 30 |

THE SENSOR

The sensor is equipped with four photodiodes for measuring four different color simultaneously. The main advantages of the use of photodiodes are:

1. Shock proof through solid state construction.
2. No wear or ageing and never need replacement.
3. Cells have no light memory and cannot be damaged by high light intensity.

A disadvantage of the use of photodiodes is the need of very sensitive pre-amplifiers. Four precision amplifiers are built in the sensor and that is why some precautions should be taken:

1. Do not let the sensor get damp or wet, and avoid any chemicals getting in to it.
2. Put the sensor on the table between measurement and NOT on top of the COLORSTAR or any hot spot. It functions at low or high room temperatures but if it gets too warm or cold the accuracy decreases. If it has been stored in a cool place, let it warm up before use, at room temperature, preferably with the COLORSTAR switched on.
3. Do not switch the COLORSTAR off and on between measurements. It will only wear the switch out and will not save you any electricity. Also the full accuracy will not be reached within half a minute after switch-on.

In case of doubt you can perform a simple test to check the sensor accuracy as well as the complete instrument (see below).

CHECK FOR CORRECT OPERATION.

During any measurement, after you have adjusted the filters to balance the COLORSTAR, try turning the diaphragm of the enlarger a few stops up and down and check whether the star remains balanced. At the most one or two LEDs in any one or two colors should light up. The exception to this is when the light gets too weak, as indicated by flashing of YELLOW LEDs, but even then there is some reserve, as you will observe when the lens is closed further. Also watch what the display shows. If the RECIPROCITY switch is set to 1.0, the displayed time should approximately double for every stop.

Most diaphragms are not really accurate in this, but for 3 stops you should get about $2 \times 2 \times 2 = 8$ or something between 7 and 9 secs. With the RECIPROCITY switch set to 1.2 one stop means $2,3 \times$ exposure time, three stops $2,3 \times 2,3 \times 2,3 = 12$ seconds.

Take care always to measure in the same following order of f:stops, to avoid the influence of mechanical hysteresis (turning from large to small openings. They are all a little larger than when you turn the other way).

These tests should be done at the S-M-Y settings that you have found for your paper, or at the approximate settings indicated by us.

Another factor influencing your measurements is lamp warm-up, especially with amateur enlargers because usually they have no forced cooling. You may check your enlarger by adjusting the diaphragm until the display shows 10.0 seconds and then let it burn for 5 minutes. If the cooling is good the time will remain constant within 0.5 seconds. If you observe a rise to 11 or 12 seconds, and also some change at the COLORSTAR, this is due to lamp warm-up.

It does not happen when you do the same test, but switching the enlarger off during the 5 minutes (try this if you suspect that the COLORSTAR is at fault).

One more problem cause is variable mains voltage. The COLORSTAR itself is stabilized for it but as the lamp is very sensitive to it you might still need a stabilizer if, in your area, the mains voltage is not constant. In your own house, the switching of electrical heaters, boilers and washing machines may cause a similar effect.

WHAT TO DO IF BAFFLED.

Let's say you have checked everything and still things keep going wrong, color deviations all the time, etc. In this case the next check may help - if you follow the directions.

1. Choose four different negatives that have given you problems, and set up to print them together on one sheet of 8x10" (20x25 cms.). So you will obtain four different prints of 4x5" approx. on one sheet.

2. For measuring of the 4 prints you use the part-integral method with the same S-M-Y settings for all four prints. Check for the right RECIPROCITY and SENSOR switch settings for all four prints. Develop the sheet and afterwards keep it complete - don't cut it.

3. After drying examine the results, you have one of these four possible categories:

a. ALL FOUR PRINTS ARE INCORRECT BUT THEY ALL HAVE THE SAME DEVIATION.

i.e. they all are too yellow or too light, too dark, etc. In this case only the S-M-Y settings need to be corrected. Read "How to correct upon the approximate settings".

b. SOME PRINTS ARE O.K., OTHERS DO HAVE THE SAME DENSITY AND COLOR BUT THIS IS NOT THE RIGHT COLOR FOR THOSE SUBJECTS.

In this case you have been measuring on a spot with dominant color in it. Read again "Part integral measurement" which tells how to find the right spot for measuring and what to do if there is no right spot. And do you already have an U.V. FILTER?

c. ONE TIME YOU ACHIEVE FOUR EQUALY GOOD PRINTS, ANOTHER TIME ALL FOUR HAVE SOME COLOR OR DENSITY DEVIATION, BUT THE SAME DEVIATION IN ALL FOUR!

In this case probably something is wrong with the chemicals. If it is mainly a color deviation you could suspect the developer. May be some traces of bleachfix have got into it - this sometimes happens. If density changes are dominating the cause might be irregular developer temperature, or temperature of pre-rinsing water.

d. EACH OF THE FOUR PRINTS DIFFERS FROM THE OTHER IN COLOR AND OR DENSITY.

One print might be too light with CYAN deviation, another the right color but too dark, etc. It is clear that the four measurement have come out very differently.

Now it is time to send the COLORSTAR in for repairs - if possible with the sheet of four prints and your comments. Please indicate the exposure times for the prints and your S-M-Y settings, and reciprocity and sensor switch position.

DIRECTIONS FOR USE OF THE TEST NEGATIVE.

1. Project the test negative to size 5x7" (13x18 cms.). You can also use half a sheet of 8x10".

2. Adjust the RECIPROCITY and SENSOR switches for your paper. Set the S-M-Y controls to the approximate settings for your paper. If you are just checking a new batch of paper, leave the S-M-Y controls at the formerly obtained settings.

3. Turn the diffusor of the sensor until you see the arrow in the large spot opening. This means you are starting with part-integral measurement.

4. Put the sensor down there where are you measuring the part of the image within the circle.

5. With the FUNCTION SELECTOR at ANALYSE adjust the filters at the enlarger to extinguish all color LEDs. Keep the exposure time above 2 seconds, but not so large that the YELLOW LEDs start flashing.

6. Switch to EXPOSE, put the paper down and press START. After development compare your print with ours. If you find that yours has a color dominant in the grey scale, then reset the M and Y controls according to the directions that you find under "How to correct upon the approximate settings". If your grey scale is lighter than ours, then decrease the SENSITIVITY setting by 7 points per step if you are comparing the four upper squares (white and light grey) or 20 points per step if you compare the four lower squares.

If your grey scale is darker than ours, increase the S-setting.

7. Start again with these corrected settings, until your print reasonably compares with ours - don't try for perfection, it can not be reached. Better take some of your own negatives now to check the result and do the fine-tuning.

8. Once you have the right setting for the part-integral method it is very simple to obtain them for all other methods too. With any negative (test negative or other) in the enlarger, the right filters set and the right exposure time in mind, change the sensor to another opening, i.e. spot 7 mm.

Measure at skin and now readjust the M and Y controls until the star goes out, readjust the S control until the right time is displayed and note the S-M-Y settings found on the box of paper, indicating it is for "spot 7 mm., skin".

Of course the same can be done for grey or any other color, any other opening, also integral measurement but then do not use the test negative but a carefully selected average "market picture".

Don't forget to direct the sensor to the lens when you use the spot openings.

TAKE CARE: the test negative can also be used in a 60x60 mm. enlarger, but it should be carefully masked to avoid stray light.

MEASURING THE EXPOSURE TIME.

Basically it's the same with color and black and white. Various methods can be used.

Two good methods are:

1. Integral measuring with the diffuser for the lens. This method is easy and fast. But you have to correct the time if the subject is placed against a dark background (flash photographs, etc.) or a white background (snow, etc.). Most times it will give you good results without any correction.

2. Measuring the darkest part of the negative, on the photograph also white, but where some details are wanted. E.g. the sunny side of a face, a light dress, white wall or cloud, etc. Each photograph does have such an almost white section.

Of course you have to programme the analyser (S-setting), so you will have different settings of the S-slider if you do use different methods of measuring the exposure time.